

BEHAVIOR OF STEEL FIBRE IN REINFORCED RECYCLED CONCRETE AGGREGATE BEAM

NUR SYUHADA BINTI THOBARI

B. ENG (HONS.) CIVIL ENGINEERING
UNIVERSITI MALAYSIA PAHANG



SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of degree of Bachelor of Civil Engineering (Hons.).

Signature :

Name of Supervisor : DR SHARIFAH MASZURA SYED MOHSIN

Position :

Date :

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

Signature :

Name : NUR SYUHADA BINTI THOBARI

Id Number : AA13089

Date :

BEHAVIOR OF STEEL FIBRE IN REINFORCED RECYCLED CONCRETE
AGGREGATE BEAM

NUR SYUHADA BINTI THOBARI

Thesis submitted in fulfillment of the requirements for the award of the degree of
B.Eng (Hons.) Civil Engineering

Faculty of Civil Engineering and Earth Resources
UNIVERSITI MALAYSIA PAHANG

JUNE 2017

ACKNOWLEDGEMENTS

All the praises are for the Almighty, Allah S.W.T. who bestowed me with the ability and strength to complete this thesis. First of all, I would like to convey my gratitude to my thesis supervisor, Dr. Sharifah Maszura Syed Mohsin for her patience and valuable guidance throughout the research and support by consulting me how to write this report in outstanding manner. She is the caring person that cares about my thesis progress and always motivated me to perform my best in this research. Without the brilliant guidance and advises from her, I would not have been able to complete this thesis successfully.

As the most precious persons in my life, I would like to extend my thankfulness to my father and mother for all their moral support during my learning here. Special thanks to my friends especially Afif Zainurin, Isma Farhan, Abdul Hadi, Qayyum Nasib, Badrul Hisyam, Ahmad Syazwan and Umi Shakila who helped me while preparing the study by giving their suggestions, assistance and supply of information which were valuable to me. The process of learning and helping each other was one of my greatest memories of friendship in my university life.

I also extend my deepest thanks to all staff of Concrete Laboratory at Universiti Malaysia Pahang for their entire kindness helped me in conducting the test and teach me during my research period here. They gave me best environment and valuable knowledge for my study both theoretically and practically. Lastly, thank you to the party who involve indirectly to attain the goal of this study. Thank you very much.

TABLE OF CONTENT

	Page
SUPERVISOR’S DECLARATION	ii
STUDENT’S DECLARATION	iii
ACKNOWLEDGEMENTS	iv
ABSTRACT	v
ABSTRAK	vi
TABLE OF CONTENT	vii
LIST OF TABLES	x
LIST OF FIGURES	ix
LIST OF SYMBOLS	xiv
LIST OF ABBREVIATIONS	xv
 CHAPTER 1 INTRODUCTION	 Error!
Bookmark not defined.	
 1.1 Introduction	 1
1.2 Problem Statement	3
1.3 Objective	4
1.4 Scope of Project	4
1.5 Importance of The Study	4
 CHAPTER 2 LITERATURE REVIEW	 6
2.1 Introduction	6
2.2 Recycled Concrete Aggregate	7
2.3 Properties of Recycled Concrete Aggregate	7
2.3.1 Densities	7
2.4 Fibre Reinforced Concrete	8
2.5 Types of Fibres	8
2.5.1 Steel Fibre	8

2.5.2	Glass Fibre	8
2.5.3	Polymer Fibre	11
2.5.4	Natural Fibre	12
2.6	Component of Concrete	12
CHAPTER 3	METHODOLOGY	22
3.1	Introduction	22
3.2	Methodology Flow Chart	23
3.3	Materials Preparation	24
3.3.1	Water	24
3.3.2	Cement	24
3.3.3	Coarse Aggregate	25
3.3.4	Fine Aggregate	25
3.3.5	Recycled Aggregate	25
3.3.6	Steel Fibre	26
3.4	Concrete Mix Design	27
3.5	Reinforced Recycled Concrete Beam	27
3.6	Tests Conducted	28
3.6.1	Slump Test	29
3.6.2	Compressive Strength Test	29
3.6.3	Flexural Strength Test	30
3.7	Preparation of Formwork	31
3.8	Preparation of Steel Reinforcement	32
3.9	Preparation of Concrete Cover	32
3.10	Casting Beams	34
3.11	Curing	34
CHAPTER 4	RESULTS AND DISSCUSION	35
4.1	Introduction	35

4.2	Slump Test	35
4.3	Compressive Strength Test	37
4.4	Flexural Test	39
4.4.1	Load versus Flexural Strength	39
4.4.1.1	NCA Beam	39
4.4.1.2	RCA Beam	40
4.4.1.3	RCA1 Beam	41
4.4.1.4	RCA2 Beam	42
4.4.1.5	Comparison of Load versus Compressive Strength	43
4.5	Maximum Load Ratio	45
4.6	Yield Load Ratio	47
4.7	Ductility	48
4.8	Cracking Pattern	49
 CHAPTER 5 DISCUSSION AND RECOMMENDATION		 51
5.1	Introduction	51
5.2	Conclusions	52
5.3	Recommendations for Future Study	53
 REFERENCES		 54
APPENDIX		59

LIST OF TABLES

Table No.	Title	Page
2.0	Type of Steel Fibre	7
3.1	Concrete Mix Design	27
4.1	Slump Test	36
4.2	The Average Value of Stress with Days	37
4.3	Flexural Test for NCA Beam	40
4.4	Flexural Test for RCA Beam	41
4.5	Flexural Test for RCA1 Beam	41
4.6	Flexural Test for RCA2 Beam	42
4.7	Load Deflection Curve	44
4.8	Summary of the Significant Value in the Load Deflection Curve for Beam	45
4.9	Maximum Load Ratio	46
4.10	Yield Load Ratio	47
4.11	Ductility	48
4.12	Mode of Failure for Beam	50

LIST OF FIGURES

Figure No.	Title	Page
2.0	Steel Fibre	9
2.1	Glass Fibre	11
2.2	Polymer Fibre	11
2.3	Natural Fibre	11
2.4	The Basic Component of the Cement-manufacturing Process	14
3.0	Methodology Flow Chart	23
3.1	Crushed Aggregate into Smaller Size	26
3.2	Sieve the Recycle Concrete Aggregate into 15mm-20mm	26
3.3	Slump Test	28
3.4	Compressive Strength Test	29
3.5	Flexural Test	30
3.6	Preparation of Formwork	31
3.7	Preparation of Steel Reinforcement	32
3.8	The making of Concrete Cover	33
3.9	Casting Beam	34
4.1	Slump Test Results	36
4.2	The Value of Compressive Strength with Different Type of Mixture	37
4.3	Load versus Flexural Strength (NCA Beam)	39
4.4	Load versus Flexural Strength (RCA Beam)	40
4.5	Load versus Flexural Strength (RCA1 Beam)	42
4.6	Load versus Flexural Strength (RCA2 Beam)	43

4.7	Comparison Load with Compressive Strength	44
4.8	Maximum Load Ratio Curve	46
4.9	Yield Load Ratio	47
4.10	Ductility Curve	48
4.11	Cracking Pattern for NCA Beam	49
4.12	Cracking Pattern for RCA Beam	49
4.13	Cracking Pattern for RCA1 Beam	49
4.14	Cracking Pattern for RCA2 Beam	50

LIST OF SYMBOLS

%	Percentage
kg	Kilogram
mm	Millimetre
N	Newton
MPa	Mega Pascal
kN	Kilo Newton

LIST OF ABBREVIATIONS

ASTM	American Section of the International Association for Testing Materials
BS	British Standard
3R	Reduce, Reuse, Recycle
pH	Potential of Hydrogen